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Processing historic meteorological data for some hydrometeorological and agrometeorological purposes. By WALES-SMITH,B.G. and WILTSHIRE,P.T.

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Evaporation Memorandum No 53

PROCESSING HISTORIC METEOROLOGICAL DATA FOR SOME HYDROMETEOROLOGICAL AND AGROMETEOROLOGICAL PURPOSES

B G Wales-Smith and P T Wiltshire

1. Introduction

Necessary hydrometeorological input to water resource and agricultural long-term planning includes the capacity to describe the spatial and seasonal distribution of long-duration (ie one month or more)

a. evaporative demand (ie potential evapotranspiration),

b. rainfall,

c. winter (or hydrologically) effective rainfall,

d. potential soil moisture deficit,

e. actual evaporation,

f. actual soil moisture deficit and

g. rainfall minus actual evaporation (ie the depletion of soil moisture reserves in summer, the restoration of soil moisture reserves to maximum in winter and the excess rainfall contribution to ground water). Thus g. includes c.

From a historic country-wide data-set of monthly point values it would be possible to

(i) produce frequency statistics, normals, etc,

(ii) estimate probable maximum/minimum values of variables over given durations and

(iii) depict the well-known droughts of the past for inter-comparison and for studies in relation to water supply and crop production records.

2. Execution

2.1 Evaluation of derived variables

The basic derived variable is potential evapotranspiration. This is estimated by means of a combination (energy balance and ventilation) equation. The equation currently used operationally by the Meteorological Office has been described by Wales-Smith and Arnott (1979 a, b).

The input data required are

a. (screen) air temperature,

b. (screen) vapour pressure,

c. duration of bright sunshine (or a measure of global or net radiation) and

d. wind speed.

H1c

To estimate values of the other derived variables rainfall data, also, are required.

2.2 Preparation of historic data-sets

Monthly averages of the meteorological variables listed at 2.1a to d are archived in computer media in the Meteorological Office for recent years. Data are available in printed form from the 1880s onwards. The following system was set up to obtain values or good estimates of the meteorological variables:

(i) select stations measuring sunshine duration and extract monthly means,

(ii) extract monthly mean (screen) air temperature,

(iii) extract monthly mean (screen) vapour pressure if recorded, otherwise estimate from nearest station with observed value, using inter-station average annual vapour pressure relationships and

(iv) estimate monthly average wind speed at 2 metres (above ground) by objective methods (see Wales-Smith, 1977 and Wiltshire and Wales-Smith, 1979.)

Data for any given station are always obtained from the earliest computer archives available in lieu of extraction from printed records, ie Monthly Weather Reports.

2.3 Preparation of place-representative series of data

At the conclusion of Stage 2.2 sets of monthly mean values of air temperature and sunshine duration and monthly mean values or good estimates of vapour pressure and wind speed will be available for varying sets of stations, increasing in number in time, some from as early as the 1880s.

Having archived these data in computer media the next step will be to use interpolation procedures similar to those employed in MORECS (Wales-Smith and Arnott, 1979a, b) to interpolate the values of each variable to selected places (sites of good quality, modern records) and to a regular grid of points.

At this stage the climatologically ordered data-sets can be made available throughout the Meteorological Office and to enquirers, generally and can be used to generate the periodic data-sets required to evaluate the variables 1a. to g. to carry out the further work described in 1(i) to (iii).

References

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